

**NAVAL SURFACE COMBATANTS IN THE 1990s:  
PROSPECTS AND POSSIBILITIES**

**The Congress of the United States  
Congressional Budget Office**

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## PREFACE

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As the Congress considers the defense budget for fiscal year 1982, the size and cost of the naval shipbuilding program will be one of the most important issues. Of particular significance will be decisions concerning surface combatant warships. This report, prepared at the request of the House Committee on Armed Services, devotes primary attention to "battle group" surface combatants (that is, destroyers and cruisers capable of operating with the Navy's aircraft carrier battle groups).

Looking ahead to the late 1980s and early 1990s, the Navy faces a substantial drop in the surface combatant force level as ships currently in the fleet reach retirement age. Because of the long lead time required to design and build new warships, decisions made in the current budget deliberations can define and constrain the characteristics of ships delivered to the fleet in the 1990s. In accordance with CBO's mandate to provide objective and nonpartisan analysis, the report offers no recommendations.

This report was prepared by Peter T. Tarpgaard of the National Security and International Affairs Division of the Congressional Budget Office, under the general supervision of David S.C. Chu and Robert F. Hale. Edward A. Swoboda and Michael A. Miller of CBO's Budget Analysis Division provided valuable assistance in preparing the cost estimates. The author gratefully acknowledges the helpful comments and assistance of Robert Faherty, Damian Kulash, Nancy Swope, and Dov Zakheim of the CBO staff, and of Professor Ernst G. Frankel of the Massachusetts Institute of Technology, Dr. Lawrence Korb of the American Enterprise Institute for Public Policy Research, and Dr. Reuven Leopold of the Pratt & Whitney Aircraft Group. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with the Congressional Budget Office.) Francis Pierce edited the manuscript; Jean Haggis prepared it for publication.

Alice M. Rivlin  
Director

April 1981



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## SUMMARY

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The decade of the 1970s brought new challenges and uncertainties to the U.S. Navy. Accustomed since World War II to unequivocal dominance at sea, the Navy struggled in the 1970s with the pressures brought about by rapidly advancing technology, the block obsolescence of large numbers of World War II ships, and a vigorous challenge at sea from a Soviet navy growing in strength and confidence.

This struggle has continued into the 1980s. It is nowhere more evident than in that category of warships known as surface combatants--cruisers, destroyers, and frigates. Surface combatants are used in a variety of naval missions, including escorting aircraft carriers as part of a carrier battle group. During a major war, carrier battle groups are intended to be the Navy's primary instrument for gaining control of the seas and for attacking the enemy base structure and forces from the sea. Frontal assaults against Soviet homeland bases would almost certainly encounter stiff resistance from Soviet naval and air forces. Battle groups might also be required to confront additional, although probably less formidable, threats distributed widely over the world's oceans.

Additional tasks undertaken by surface combatants include their employment in surface action groups and as escorts for amphibious forces, underway replenishment groups, and convoys. Surface action groups are naval strike groups that do not contain an aircraft carrier. They are used today in the Middle East and the Caribbean, and could provide forces responsive to other crises in the Third World. Amphibious forces invade land areas from the sea. Underway replenishment groups replenish fuel, ammunition, and stores for warships at sea and are essential for sustained naval operations away from home waters. Merchant ship convoys will almost certainly require vigorous protection against enemy interdiction, as they have in past wars. All of these functions will require surface combatants beyond those needed for carrier battle groups.

Looking ahead to the late 1980s and early 1990s, the Navy faces a substantial drop in the surface combatant force level as the ships delivered in the late 1950s and early 1960s reach

retirement age. At the same time, the challenge posed by the forces of potential adversaries has continued to grow.

In addressing this challenge, several related questions must be considered:

- o How large a surface combatant force will the Navy have in the 1990s, given the number of new ships already authorized and the ships now in the fleet that will not yet have reached the end of their service lives?
- o How might recent technological developments affect the likely role of future surface combatants?
- o Given these technological developments, and alternative views of naval strategy, what mix of surface combatants might be considered within whatever budget level the Congress selects?

These questions are the focus of this paper.

#### CURRENT FORCES

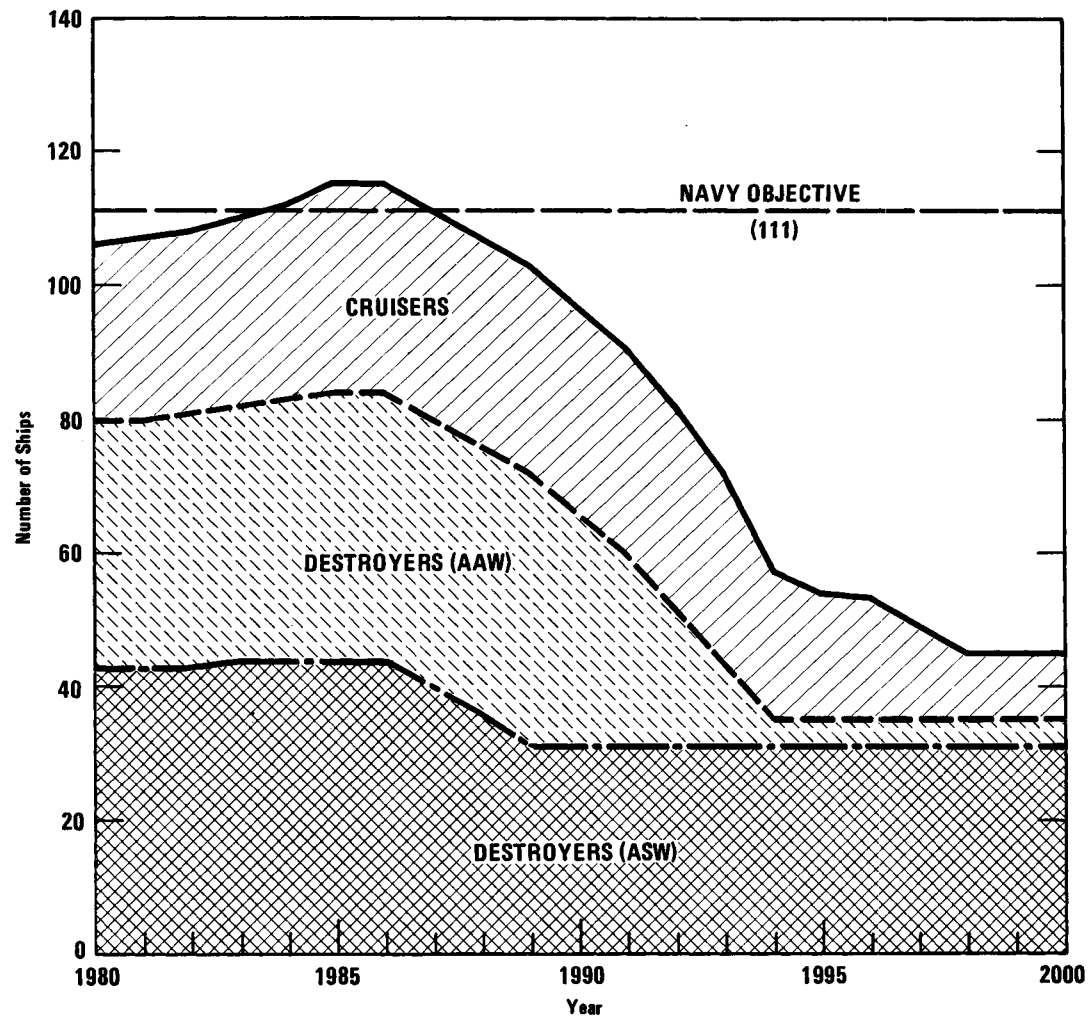
Surface combatants are currently classed as either cruisers, destroyers, or frigates depending upon their general size and capabilities. Cruisers and destroyers are also classed by the Navy as "battle group" surface combatants and are intended for use in offensive strikes with aircraft carrier battle groups. Frigates, smaller and less capable ships, are normally intended for less demanding missions, such as convoy escort and protection of underway replenishment ships.

#### Impending Decline in Numbers of Battle Group Surface Combatants

The Navy perceives the most acute future deficiencies as occurring in the battle group category, since many cruisers and destroyers now in the fleet will reach retirement age in the period 1985-1995. The number of cruisers and destroyers will decline from their present level of 116 (nine of which are still under construction) to about 45 by the end of the century in the absence of further ship construction (see Summary Figure 1). Just maintaining the current size of the cruiser/destroyer force will require an average delivery rate of about 6.5 new ships per year during the 10-year period 1987-1997, significantly higher

Summary Figure 1.

## Projected Force Levels for Battle Group Surface Combatants



Note: Includes authorizations through fiscal year 1981. Objective of 111 was specified to the Congress in Navy testimony of February 1980. Testimony given to the Congress in March 1981 suggested a new, higher level of 137.

than the average rate of 3.3 new cruisers and destroyers authorized per year during the past decade.

The Navy believes that at least 111 battle group surface combatants are required to support its mission requirements--a minimum, the Navy stresses, that is adequate only under optimistic assumptions about a future worldwide war. Moreover, these minimum requirements may not fully reflect needs brought about by added peacetime deployment requirements, such as the current deployment in the Indian Ocean.

Force level requirements from the Navy's 1980 testimony, the basis of the most recent Congressional shipbuilding decisions, are used in this report, but the new Administration's higher goals are also considered.

#### Upgrading Needed

Although a warship's hull and machinery can be built to last for 30 years, its combat systems usually become obsolete much sooner and must be updated periodically to remain effective. In the 1980s, many of the current surface combatants will enter their third decade of service and will need modernization, particularly for their anti-air warfare (AAW) missile systems. The Navy has developed three combat system upgrade programs for ships in this category: the CG/SM-2 Upgrade, the New Threat Upgrade, and the DDG-2-Class Upgrade. The CG/SM-2 Upgrade and New Threat Upgrade will enable older ships to use the Navy's new Standard SM-2 missile and will provide particularly dramatic capability improvements at a relatively modest cost. For example, the CG/SM-2 Upgrade and New Threat Upgrade would give the 10 ships of the DDG-37 class a modern, long-range AAW capability, exceeding the AAW range of even the new CG-47 cruiser. These 10 ships could be upgraded for a total cost of about \$260 million, or one-fourth the procurement cost of a single CG-47 cruiser.

#### SURFACE COMBATANTS IN THE FUTURE: NEW TECHNOLOGIES AND NEW CAPABILITIES PORTEND A GROWING ROLE

Once the centerpiece of naval forces, the surface combatant was superseded in World War II by the aircraft carrier and submarine as the primary naval striking arm. Since that time, surface combatants have served primarily as escorts, supporting aircraft carrier operations and defending noncombatants from attack. Now, new technological developments hold out the prospect of



substantially improved capabilities for surface combatants--capabilities that will not only improve their present escort capabilities but may also restore some degree of independent strike capability to them.

These developments include:

- o Cruise missiles, which will give surface combatants a long-range offensive strike capability against both ship and land targets;
- o Towed-array sonars, which will permit detection of submarines at long range;
- o Helicopters and/or vertical/short take-off and landing (V/STOL) aircraft, which will provide surveillance and targeting for long-range cruise missiles and a means of prosecuting long-range submarine contacts; and
- o Anti-air warfare improvements, which will significantly strengthen capabilities against both cruise missiles and high-performance aircraft, making future surface combatants much more dangerous to attack.

#### OPTIONS FOR THE FUTURE: CHOICES REFLECT COST AND STRATEGY

In considering future naval shipbuilding programs, the Congress not only must consider the perennial problem of how to reconcile escalating costs with ship capability but must also make judgments about future naval strategy and how the Navy might be used in future crises and conflicts.

The Navy believes that the most efficient way to gain and maintain control of the seas is to destroy those hostile forces capable of challenging that control. It would use carrier battle groups as the primary instrument of such offensive action. The capabilities required by these battle groups, and therefore by the surface combatants that operate with them, are determined by the maximum resistance they might encounter--that is, resistance to an offensive assault against Soviet homeland bases.

This strategy, however, is by no means the only one the Navy may be called upon to execute in the future. Depending upon the circumstances at hand, the national command authority may find it advisable (because of the nature of the crisis, the disposition of

Soviet forces, vulnerability to nuclear attack, or risk of escalation) for the Navy to pursue some strategy other than a frontal assault on Soviet home bases. The Navy may be required to face a distributed threat by Soviet and/or other naval forces that would require a different mix of ships, including a sufficient number of surface combatants to protect U.S. interests over a relatively long period of time in distant waters. Indeed, recent events in the Middle East have been of this nature, straining the Navy's resources with demands for further standing force deployments.

#### Alternative Ship Types

With these considerations in mind, four representative surface combatants may be used to illustrate a range of alternatives with respect to modern surface combatant ship designs. These are:

- o Nuclear Cruiser (CGN-42). A nuclear-powered warship employing the best weapons and sensors currently available, the CGN-42 would have the operational flexibility inherent to the unlimited steaming range of nuclear power. It would have the new, high-capability AEGIS AAW system, offensive cruise missiles, LAMPS III helicopters, a high-power active sonar and a towed-array passive sonar for antisubmarine warfare (ASW), a large missile capacity (122 missiles) in the new vertical launch system (VLS), and the latest in command, control, and communications equipment. All these features would give the ship excellent capabilities across a broad spectrum of naval missions. The CGN-42 would be an expensive ship, with an acquisition cost of about \$1.34 billion—including nuclear fuel equivalent to about 3 million barrels of oil. 1/
- o AEGIS Cruiser (CG-47). A smaller, conventionally powered cruiser, the CG-47 has essentially the same formidable combat system as the nuclear cruiser but lacks the unlimited steaming range of nuclear power. Ships of this class are currently being procured by the Navy at an estimated cost of about \$1.02 billion per ship.

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1/ All costs in this summary are in constant fiscal year 1982 dollars.

- o Battle Group Destroyer (DDGX). A new surface combatant design, the DDGX is being developed by the Navy primarily for operations with aircraft carrier battle groups. Its combat system will emphasize the AAW and ASW capabilities currently believed by the Navy to be most necessary for carrier battle group operations. Its AAW system will have a powerful AEGIS-like radar, and its ASW system will be oriented toward active sonar screening using the large, low-frequency SQS-53 sonar. The estimated procurement cost of the DDGX is about \$550 million per ship.
- o Open Ocean Destroyer (DDGY). A hypothetical surface combatant capable of operating with carrier battle groups, the DDGY would be less optimized for that mission in the interest of providing it with a better capability for independent, open-ocean operations. It would have a less powerful air search radar and a less powerful active sonar than the DDGX, but would be equipped with LAMPS III helicopters, a towed-array sonar, and a large-caliber gun. Somewhat smaller but faster than the DDGX, the DDGY would have a lower unit procurement cost, estimated at about \$375 million.

Specific characteristics of these alternative ship types are shown in Summary Table 1.

#### Alternative Shipbuilding Programs

Choosing which ships to build among these alternatives depends upon one's perceptions of future naval combat and wartime strategy.

Four packages of the ships discussed above consistent with different perceptions of future naval strategies are presented in Summary Table 2. Each package, or program option, is structured to have approximately the same 10-year (1986-1995) investment cost--about \$33 billion. This is the estimated cost of the program recommended by the Navy in testimony to the Congress in 1980, presented here as Option II. Life-cycle costs of the program alternatives vary only about 10 percent about the mean for all options, with Option I having the lowest life-cycle cost and Option IV the highest. All options assume procurement of at least 18 CG-47-class ships (three options have 24) and would support at least the six two-carrier battle groups envisioned in the 1980 Navy testimony.

SUMMARY TABLE 1. CHARACTERISTICS OF ALTERNATIVE SHIP TYPES

	Nuclear Cruiser (CGN-42)	AEGIS Cruiser (CG-47)	Battle Group Destroyer (DDGX) <u>a/</u>	Open Ocean Destroyer (DDGY) <u>b/</u>
Displacement (tons)	12,000	9,100	6,000	5,000
Maximum Speed (knots)	30+	30	29	30
Endurance Speed (knots)	--	20	18	20
AAW Systems				
Search radar	SPY-1	SPY-1	MFAR	3-D <u>c/</u>
Fire control radar	4 MK99	4 MK99	2 MK99 or 2 Agile Beam	2 Agile Beam <u>d/</u>
Launcher system	VLS	VLS	VLS	VLS
Missile capacity	122	122	90	90
Missile type	SM-2	SM-2	SM-2	SM-2
ASW Systems				
Towed-array sonar	SQR-19	SQR-19	None	SQR-19
LAMPS-compatible	Yes	Yes	Yes	Yes
Number of aircraft	Two	Two	None	Two
Hull-mounted sonar	SQS-53	SQS-53	SQS-53	SQS-56
ASW weapons	ASROC/MK32 Tubes	ASROC/MK32 Tubes	ASROC/MK32 Tubes	ASROC/MK32 Tubes
ASuW Systems				
Missiles	Tomahawk (TASM)	Tomahawk (TASM)	Tomahawk (TASM)	Tomahawk (TASM)
Guns	Two 5"/54	Two 5"/54	None	One 155mm (6")
Land Attack Systems				
Missiles	Tomahawk (TLAM)	Tomahawk (TLAM)	Tomahawk (TLAM)	Tomahawk (TLAM)
Guns	Two 5"/54	Two 5"/54	None	One 155mm (6")
Estimated Cost (millions of fiscal year 1982 dollars)				
	\$1,340	\$1,018	\$550	\$375

a/ A final decision on the configuration of the DDGX has not yet been made. The characteristics listed above may be changed by the Navy as the design process progresses.

b/ For DDGY weight and cost rationale, see Appendix D.

c/ SPS-48E 3-D and SPS-49 2-D air radars as used on the latest U.S. ships supplemented by horizon and high-elevation search by agile beam fire control radars. Later units might have a new-generation air search radar.

d/ Agile beam is used here as a generic term that includes such specific concepts as the Terminal Engagement Radar (TER) or Flexible Adaptive Radar (FLEXAR). This system would be capable of simultaneously tracking and engaging multiple targets while supplementing the air search function in the horizon and zenith areas.

SUMMARY TABLE 2. ILLUSTRATIVE \$33 BILLION 10-YEAR PROGRAMS FOR SURFACE COMBATANT WARSHIP CONSTRUCTION, FISCAL YEARS 1986-1995

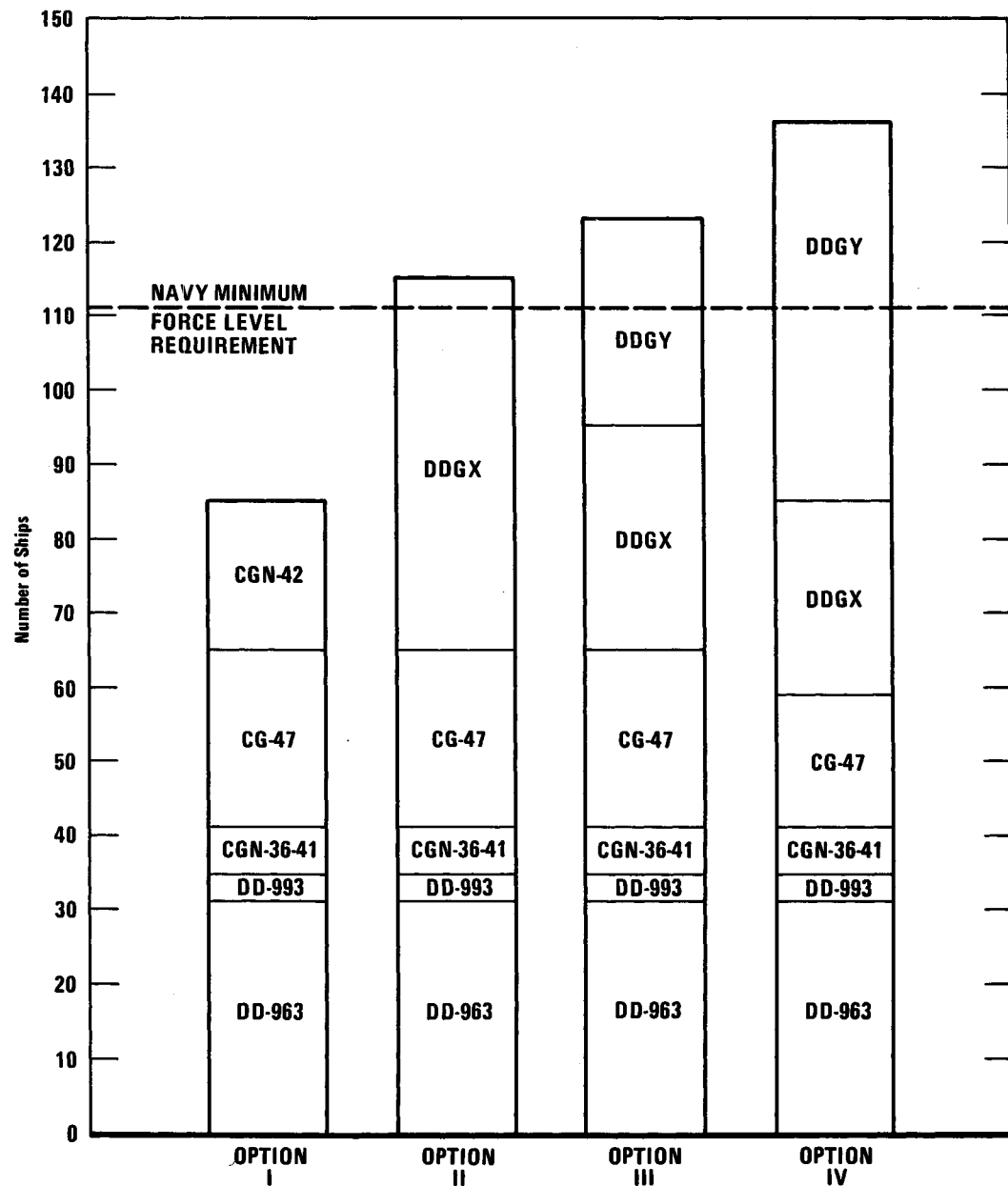
Option	Ship Type	New Ships Authorized			Percent of Current Force Level at Sea in Year 2000
		In 1985 or Earlier	In 1986 Through 1995	Through 1995	
Option I: Emphasize Capability	CGN-42	0	20	20	77
	CG-47	18	6	<u>24</u>	
				44	
Option II: Emphasize Battle Group Operations	CG-47	18	6	24	105
	DDG X	1	49	<u>50</u>	
				74	
Option III: Balance Battle Group and Other Mission Emphasis	CG-47	18	6	24	113
	DDG X	1	29	30	
	DDGY	0	29	<u>29</u>	
				83	
Option IV: Emphasize Broad-Ocean Distributed-Force Operations	CG-47	18	0	18	124
	DDG X	1	25	26	
	DDGY	0	51	<u>51</u>	
				95	

The four options have different consequences as to the number and types of ships that would be at sea in the fleet in the year 2000. The force level and force structure resulting from each of the options is displayed in Summary Figure 2. The dashed line indicates the Navy's minimum force level requirement as identified in 1980 Navy testimony. Summary Table 3 shows the mission support implications of each option, assuming that priority is given to supporting six two-carrier battle groups.

Option I. The advocate of Option I accepts the Navy's view that offensive strikes into enemy waters will be the key to victory in the future and believes only the most capable ships

Summary Figure 2.

Battle Group Surface Combatant Force Levels and Structures  
in the Year 2000: Four Equal-Cost Alternatives



SUMMARY TABLE 3. MISSION SUPPORT IMPLICATIONS OF ALTERNATIVE PROGRAM OPTIONS IN THE YEAR 2000

Mission Capability	Option			
	I	II	III	IV
Number of Two-Carrier Battle Groups Supported	6	6	6	6
Number of Surface Action Groups Supported	0	3	4	5
Number of Amphibious Escort Ships	9	11	13	18
Number of Underway Replenishment Escort Ships	24	32	32	32
Number of Convoy Escort Ships	66	66	68	70

will be equal to that task. Although sympathetic to the need for more ships, the advocate of Option I is skeptical of claims that capability compromises in the interest of cost reduction yield more overall fleet effectiveness. The advocate of Option I believes that quality must govern, despite the fact that more ships could be bought at any given level of investment if some less expensive ships were procured. This option would produce sufficient ships to form six well protected two-carrier battle groups. There would not be enough ships, however, to form any surface action groups or to provide the number of escorts for amphibious groups, replenishment groups, and convoys recommended by the Navy in its 1980 testimony.

Option II. The advocate of Option II also accepts the Navy's offensive strike strategy and wants the best capabilities available for surface combatants, but he regards the "no-compromise-on-capability" approach of Option I as unrealistic and likely to result in a dangerously small Navy. He believes it is not only possible but necessary to make judicious choices on warship features that will provide ships adequate to their mission and sufficiently affordable so as to be procured in adequate numbers.

In making such choices, the advocate of Option II believes that battle group operations against intensive enemy opposition in a forward area represent the proper reference scenario. Thus, he favors buying the DDGX, which, though lacking the unlimited steaming range and top-line combat suite of the CGN-42, has the capabilities needed for battle group operations and, being substantially less expensive than the CGN-42, can be procured in larger numbers for any given level of investment. This option was favored by the Navy in its testimony to the Congress in 1980, and meets the force level objectives reflected in that testimony.

Option III. The advocate of Option III agrees with the concept of offensive battle groups and supports the DDGX as contributing to battle group capability. He perceives a variety of other tasks for the Navy, however, such as extended patrol and presence operations in the Third World, where concentrated battle groups may not be the most efficient or appropriate application of naval forces. These tasks might be more likely to involve wide-ranging operations against a distributed threat rather than a single concentrated force. He therefore supports putting some resources into the DDGY, which, though capable of battle group operations, is oriented more toward independent, open-ocean operations than the DDGX. This, he believes, will produce a better balance of capabilities against the uncertainties of the future than procurement of only the DDGX. As shown in Summary Table 3, this option provides sufficient ships to form four surface action groups, in addition to the six battle groups and the escort forces.

Option IV. The advocate of Option IV also recognizes the importance of tactical air power and supports the concept of carrier battle groups. He is less convinced than the advocates of the previous options, however, that a frontal assault by battle groups in enemy waters is the best strategy for a future war. He believes that, for a variety of reasons, it is more likely that a future naval war will involve worldwide operations against a much more distributed threat than the concentrated forces of the battle-group scenario. Although favoring the DDGX program as necessary to support battle group operations in the 1990s, he perceives a higher utility for more numerous, independently operating naval groups and therefore supports putting relatively more emphasis on the DDGY. This approach, he believes, would provide not only more ships for the same investment, but more ships of a kind most likely to be needed in the future. Option IV provides sufficient ships to form five surface action groups in



addition to the six battle groups, and provides at least seven more escorts than any other option.

#### LARGER NAVAL FORCE LEVELS: SOME IMPLICATIONS

The options presented above reflect the Navy's requirements and force level planning as presented to the Congress in 1980 testimony. The \$33 billion assumed investment cost for each option is CBO's estimate of the 10-year investment cost of the program recommended by the Navy in that testimony (Option II).

Recently the Reagan Administration has announced its intention to pursue a more ambitious naval program, including building and maintaining a force of 15 aircraft carriers. <sup>2/</sup> The program proposed by the new Administration includes higher force level goals for other types of ships as well, including a new goal of 137 battle-group-capable surface combatants.

Of the options discussed above, only Option IV provides enough ships to support seven battle groups, while still meeting the Navy's other mission requirements. Programs to support seven two-carrier battle groups using the force structure approach taken by the other options would require an even higher level of investment, with about \$50 billion being required over the 10-year period as against \$33 billion used here. At any level of investment, however, whether \$33 billion, \$50 billion, or some other amount, these options still illustrate two key principles: the ship capabilities needed depend upon one's view of future naval strategy, but an emphasis on high-cost ships reduces the force levels that can be achieved within a given budget.

#### SURFACE COMBATANTS FOR THE 1990s: A PROBLEM FOR TODAY

Although the projected decline in battle group surface combatant force levels will not occur until the 1990s, even

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<sup>2/</sup> See "FY 1982 Shipbuilding and Conversion Budget Request," statement of Vice Admiral William H. Rowden, USN, Deputy Chief of Naval Operations for Surface Warfare, before the Subcommittee on Seapower and Strategic and Critical Materials, House Committee on Armed Services (March 25, 1981; processed). See also "Interview with the Secretary of the Navy," Sea Power (March 1981), pp. 17-30.

if present shipbuilding policies are maintained, the long lead time required to design and build modern warships means that replacement programs must begin well before the required delivery times. This is true not only for the ships themselves but also--and most particularly so--for the combat system components that they will carry. Thus, research and development decisions made in the next year by the Administration and by the Congress can define and constrain ship procurement options in the mid-1980s and, consequently, the number of ships delivered to the fleet in the 1990s. For Option II to be a real shipbuilding alternative in 1986, funding for DDGX design and combat system development must be provided in fiscal year 1982. Similarly, for Options III and IV to be real alternatives, research and development funding for DDGY design and combat system development must also be provided. This would probably require funding of about \$100 million to \$150 million per year depending upon the number and status of ongoing projects.

In addition, the ships currently in the fleet will require periodic upgrading to maintain their effectiveness in a rapidly changing technological environment. This will require continuing research and development funding for modernization programs, such as the CG/SM-2 Upgrade and the New Threat Upgrade, as well as funds actually to accomplish the upgrades when the new systems become available.